Course guide
250802 - 250802 - Geology for Engineering

Last modified: 25/01/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: MASTER'S DEGREE IN GEOTECHNICAL ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: MARCEL HURLIMANN ZIEGLER

Others: MARCEL HURLIMANN ZIEGLER, JOAN MARTÍNEZ BOFILL

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13309. To characterize the geological environment and its interaction with civil works.
13310. To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose laboratory testing programmes.

Generical:
13300. To apply advanced knowledge in sciences and technology to the profesional or research practice.
13301. To lead, coordinate and develop integrated projects in Geo-Engineering.
13304. To incorporate new techncologies and advanced tools in Geo-engineering into profesional and research activities.
13305. To conceive Geo-engineering as a multi-disciplinary field that includes relevant aspects from geology, sismology, hydrogeology, geotechnical and earthquake engineering, geomechanics, physics of porous media, geophysics, geomatics, natural hazard, energy and climate interactions.
13306. To promote innovation for the development of methodology, analyses and solutions in Geo-engineering
13307. To tackle and solve advanced mathematical problems in engineering from the drafting of the problem to the development of formulation and further implementation in computer programs. Particularly, to formulate, code and apply analytical and numerical advanced computational tools to project calculations in order to plan and manage them as well as to interpret results in the context of Geo-engineering and Mining engineering.

TEACHING METHODOLOGY

The course consists of 1,3 hours per week of classroom activity (large size group) and 0,3 hours weekly with half the students (medium size group).

The 1,3 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 0,3 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

To conceive soils and rocks as porous media governed by Solid and Fluid Mechanics.
To characterize the geological environment and its interaction with civil works.
To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose laboratory testing programmes.
To formulate and implement Finite Element and Finite Differences numerical models with the objective to analyze the processes that govern ground response, to interpret field information and to predict soil response.

* To recognize the problems in Civil Engineering.
* To relate the problems in Civil Engineering to the characteristics of the geological environment.
* To conceptualize the problem in Civil Engineering in order to analyze, model and solve them.
* To apply continuum media concepts to analyze and model problems in Civil Engineering.
* To apply numerical techniques to solve Civil Engineering problems.

- Superficial formations. Origin, layer arrangement, geomechanical properties and implications with regards to soil geological survey. Formations of glacial, colluvial, alluvial, coastal and residual origin.
- Characterization of the rock mass. Geomechanical classifications. Soft rocks.
- Soil survey. Design. Geological and geomechanical model. Programming of the survey campaign. Techniques used.
- Soil excavability. Criteria to determine the procedure for mechanical and explosive excavation.
- Geological aspects of open excavations. Slope stability. Soil foundation determinant conditions. Alterations of the physical environment.
- Geological aspects of the survey and execution of lineal works. Geological and morphological determinants for the design. Slopes, masonry works and earth movements. Alterations and interactions with the physical environment.
- Geological aspects of the survey and excavation of underground works. Lithology and structure. Hard points: exits, weakness zones (faults); water; in situ stresses. Geological monitoring during excavation.
- Geological aspects of the survey and construction of dams. Study of the closure: ground requirements with regards to the type of dam, strength and seepage. Study of the basin: slope stability and seepage. Geological monitoring of the works. Alterations of the physical environment.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	9,8	7.83
Hours large group	25,5	20.38
Hours small group	9,8	7.83
Self study	80,0	63.95

Total learning time: 125.1 h

CONTENTS

1. INTRODUCTION

Description:
Objectives and Organization of unfulfilled. The geological model and the geomechanical model. the tools

Full-or-part-time: 2h 24m
Theory classes: 1h
Self study : 1h 24m

Geomechanical 2-FEATURES OF SURFACE FORMATIONS

Description:
geomechanical properties associated with formation of the glacial and colluvial deposits: gradation, permeability, strength and deformability. spatial arrangement and implications for the geological reconnaissance. geomechanical properties associated with formation of heavy, alluvial and coastal deposits: gradation, permeability, strength and deformability. spatial arrangement and implications for the geological reconnaissance.

Specific objectives:
Show the influence of the processes of formation of waste, glacial and colluvial deposits in its hydraulic and mechanical properties. Provide criteria to understand the spatial distribution and geometry of these deposits show the influence of the processes of formation of heavy, alluvial and coastal its hydraulic and mechanical properties deposits. Providing criteria to understand the spatial distribution and geometry of these deposits

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

3- FEATURES OF THE ROCKS

Description:
Strength and deformability of the rock matrix: phases. Effect of mineralogical and textural components. Properties of the major groups of rock hardness and abrasiveness of rocks and determination. alterable soft rock. Durability tests. Rated Franklin

Specific objectives:
Show the different deformational behavior of rocks (elastic, plastic, elastic-plastic) and the phases to break. Explain the influence of textural parameters such as foliation or porosity in the strength properties of the rock. Submit mineralogical and textural components that determine the hardness, abrasiveness and durability of rocks and trials for determination

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

4 - CHARACTERISTICS AND PROPERTIES OF ROCK MASS

Description:
Concept of rock mass. Type discontinuities and resistance properties of the joints. Barton and Choubey criteria. Objective tests cutting RQD Index rankings Q Rock Mass Rating
Field practice
Practices: stereographic projection

Specific objectives:
Introduce the concept of rock mass. Explain how the geometric characteristics and condition of discontinuities (roughness, waviness, alteration) controls its tough behavior provide the elements for the characterization and evaluation of the quality of the rock mass on the ground through simple procedures Enter the procedure for Hoek and Brown evaluation of rock mass strength and recent improvements. Presenting the different procedures for assessing the deformability of the rock mass. Identification of different types of rock mass discontinuities. Learning far discontinuities with compass. Data collection necessary for the geomechanical classifications

Full-or-part-time: 36h
Theory classes: 3h
Practical classes: 4h
Laboratory classes: 8h
Self study : 21h

5 - reconnaissance

Description:
T5 reconnaissance
Workshop - geological maps

Full-or-part-time: 9h 36m
Theory classes: 2h
Practical classes: 2h
Self study : 5h 36m

6 - GEOLOGICAL ASPECTS OF earthworks

Description:
Parameters excavation systems excavabilitat terrain conditions of seismic criteria. Fookes Petiffer criteria and mechanisms of instability in rock cuttings and natural slopes

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

7 -ASPECTOS GEOLÓGICOS DE LA CONSTRUCCIÓN DE CIMIENTOS EN EL TERRENO

Description:
T7 GEOLÓGICOS ASPECTS OF CONSTRUCTION OF THE LAND CIMIENTOS

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

8 - GEOLOGICAL ASPECTS OF LINEAR WORKS

Description:
T8 GEOLOGICAL ASPECTS OF LINEAR WORKS

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

9 -ASPECTOS GEOLÓGICOS LOS TÚNELES Y EXCAVACIONES SUBTERRÁNEAS

Description:
T9 geological aspects tunnels and underground excavations
Problems - tunnels

Full-or-part-time: 12h
Theory classes: 3h
Practical classes: 2h
Self study : 7h

10- ASPECTOS GEOLÓGICOS DE PRESAS Y EMBALSES

Description:
T10 GEOLÓGICOS ASPECTS OF DAMS AND Embalses
dams problems

Full-or-part-time: 21h 36m
Theory classes: 3h
Practical classes: 2h
Laboratory classes: 4h
Self study : 12h 36m

GRADING SYSTEM

SEE castellano for details:

EXAMINATION RULES.

SEE castellano for details:

BIBLIOGRAPHY

Basic:
- González de Vallejo, L.I. Ingeniería geológica. Madrid: Prentice Hall, 2002. ISBN 84-205-3104-9.
- Goodman, R.E. Engineering geology : rock in engineering construction. New York: John Wiley and Sons, 1993. ISBN 0471544248.
- Blyth, F.G.H.; De Freitas, M.H. A Geology for engineers. 7th ed. London: Edward Arnold, 1984. ISBN 0713128828.